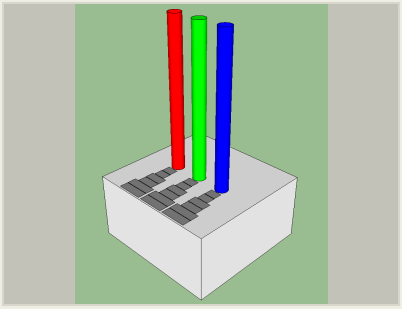
A Compact In Situ Sensor for Measurement of Absorption and Backscattering in Natural Waters, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

We propose to develop an active sensor for in situ measurement of the inherent optical properties (IOPs) absorption and backscattering at multiple wavelengths. Multi- or hyper-spectral absorption of particles and dissolved materials is routinely measured in the laboratory and in situ in order to characterize, for example, the quantities and types of phytoplankton based on concentrations of specific absorbing pigments. Similarly, backscattering is employed to estimate the concentration of suspended material. Measurements of absorption and backscattering concurrently, and at multiple wavelengths, are useful as proxies for biogeochemical measurements such as particle composition, concentration of particulate organic carbon, and particle size distribution, as well as for remote sensing calibration and validation. The current state of the art for phytoplankton observation using optical sensors on autonomous platforms relies on linking biomass with optical backscattering and chlorophyll. The ability to quantify phytoplankton using absorption not only overcomes limitations of backscattering and fluorescence-based approaches, but multi-spectral (visible wavelength) measurements of absorption also provide the means to discern the presence of accessory pigments and pigment packaging, ultimately leading to not only improvements in phytoplankton biomass estimates, but also the potential for resolving phytoplankton functional types. Briefly, the proposed sensor emits a collimated beam of light into the water and measures the backscattered light as a radial function from the beam location. An inversion algorithm is then used to convert this backscattered intensity as a function of distance from the beam to the inherent optical properties absorption and backscattering. Multiple source wavelengths are used and the sensor is packaged in a compact, flat-faced geometry easing integration into autonomous platforms.



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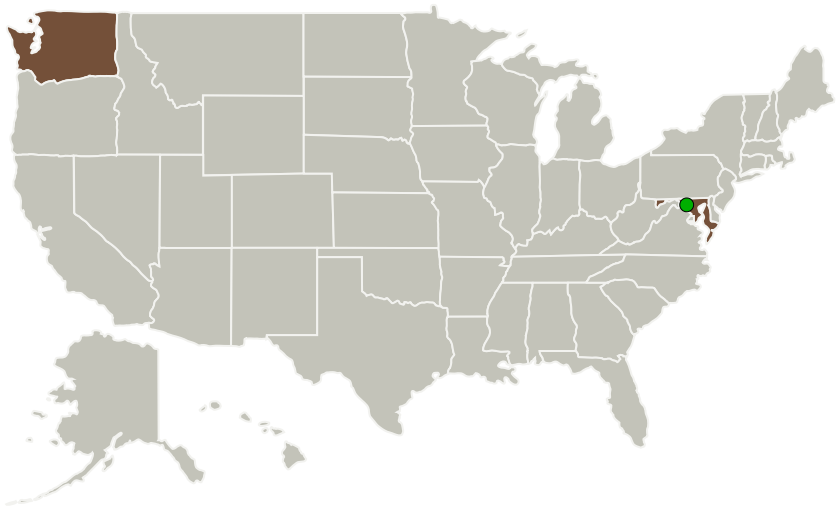
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Sequoia Scientific, Inc.	Lead Organization	Industry	Bellevue, Washington
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Washington

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137809)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Sequoia Scientific, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

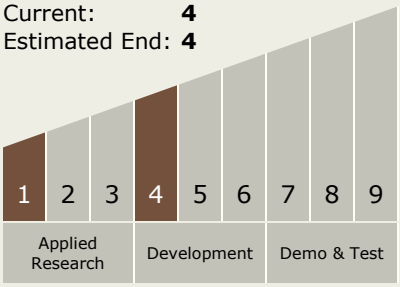
Carlos Torrez

Principal Investigator:

Wayne H Slade

Technology Maturity (TRL)

Start: **1**
Current: **4**
Estimated End: **4**



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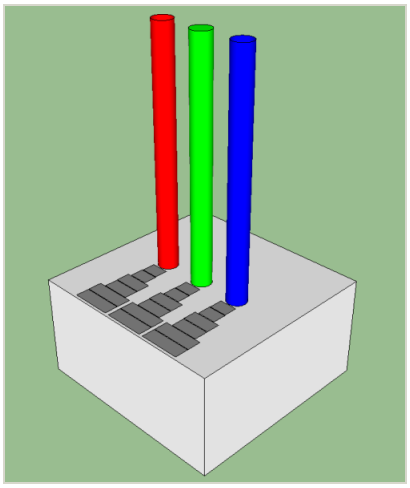
Images



Project Image
A Compact In Situ Sensor for Measurement of Absorption and Backscattering in Natural Waters
(https://techport.nasa.gov/image/132919)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System